Background Information for Missouri Quail Hunting Season Structure

Prepared 29 July 2005

Thomas V. Dailey, Ph. D.
Resource Scientist
Missouri Department of Conservation
1110 S. College Avenue
Columbia, MO 65201

Summary

Quail Abundance and Hunting History:

1. Quail abundance and hunting are on a long-term downward trend with lowest numbers in southern Missouri.

2. MDC quail management changed in the 1980s when annual harvest management was replaced by a focus on habitat management. The current hunting season, 1 November to 15 January, began in 1986.

3. Quail harvest mortality adds to natural mortality under certain conditions, resulting in potentially lower breeder numbers.

4. A hunting season that ends 'early' reduces the potential additive effect of harvest mortality; evidence points to January as a risky period for quail.

5. There is uncertainty, however, about the application of the above research findings to Missouri's statewide hunting regulations. We do not know to what, if any extent, hunters are reducing local quail populations, or if such depopulation would cause large-scale quail decline. Moreover, quail have the theoretic capacity to rebound from hunting-caused reduction in breeder abundance via density-dependent reproduction.

6. On the other hand, we are certain that an early hunting opening date makes more quail available to hunters.

7. Today's quail hunters are far fewer in number than in the past; however, those that remain are more efficient and consequently could have a relatively greater impact on today's fragmented populations of quail.

8. Southern Missouri quail hunters spend proportionally more time hunting compared to northern hunters.

9. Missouri quail hunters prefer 1 November-31 January season; preference is evenly split between 23 November-31 January and 1 November-15 January seasons. Southeast Region preference is evenly split among these 3 seasons; Bootheel hunters, however, favor 23 November-31 January season.

10. Hunting season structure in nearby states is highly variable with a range of opening dates of 26 October – 19 November, and a closure range of 19 December – 28 February. Several states split season dates by latitude or longitude.

11. In the context of quail restoration, several TWS journal articles in 2004 called for a more conservative approach to harvest management.

This report provides information for making decisions about Missouri's quail hunting season dates. The following topics are reviewed:

History of Missouri Quail Hunting Regulations

Wildlife managers in the Midwest have long-held concepts regarding small game harvest management. MDC's Steen, in 1946, noted that good management demands that harvest by the gun come as close to the production period as reasonably possible. Common Missouri quail season opening dates were 1 and 10 November, and closing dates included 15 and 31 December, and 15 January. North and south Missouri had different season dates in 1961 and 1985. During the 1950s to mid-1980s, MDC quail hunting regulations were set each year based on population indices.

MDC quail management changed significantly in the 1980s when annual harvest management was discontinued and replaced by a focus on habitat management. In 1986, Rich Cannon recommended the hunting season that we currently use, 1 November to 15 January. This season structure was largely based on research in Illinois that showed harvest mortality in January added to natural mortality and resulted in a decline in breeder numbers. Cannon's summary of the regulation setting process was published in 1986 in *Missouri Quail: At the Crossroads of the Future*. The section on hunting regulations was titled *Seeking a Balance*, and contained a reference to professional opinions of MDC researchers that the closing date of 15 January was a compromise between recreational demand for a longer season, and the quail's sensitivity to the effect of mid-winter hunting (as published by Roseberry). The change in MDC quail management, from a focus on harvest management to habitat management, was codified in 1987 when regulations were placed in the Missouri Conservation Commission Wildlife Code. There was uncertainty about the removal of annual consideration of quail hunting regulations from the regulation-setting process, however, the 1987 MDC bobwhite plan called for periodic examination of quail population trends under the new stable hunting regulations.

Biological Considerations

Population Mechanisms

The underlying concepts of small game harvest management have changed over the past decade. The early concept held that there was a doomed-surplus of quail each winter and that harvest up to a threshold did not reduce breeder abundance. The current perspective holds that "Historical data reveal harvest mortality generally adds to natural mortality from start to end of hunting season for quail." (Guthery 2002:114). These data include studies in Illinois, Florida, North Carolina, and Kansas (Roseberry 1979, Pollock et al. 1989, Robinette and Doerr 1993, and Williams et al. 2004b, respectively). Williams et al. (2004a) argue that recent scientific testing and models indicate that the principles that led to liberal regulations are flawed to some degree, or at least overly simplistic.

The above studies identified two ways in which harvest mortality adds to natural mortality: (1) absolute harvest mortality is additive, and/or (2) the timing of harvest mortality is additive. The effect of timing of harvest is based partly on the phenomena that high-producing small game populations face a habitat 'bottle-neck' in winter as cover and food are reduced, resulting in increased natural mortality (predation, cold, disease, etc.), and subsequent rapid decline in abundance. The result of this is that harvest can have less effect on breeder abundance if it occurs prior to major periods of natural mortality. The practical result is that 1 quail harvested in early November does not necessarily result in 1 less breeder the next spring. As natural mortality increases with time, the ratio of quail harvested to quail removed from the breeding population approaches 1 (total additivity).

The situation faced by quail that survive major periods of natural mortality (bottle-neck) also affects the likelihood that hunting in winter could decrease breeder numbers. The probability that quail will survive to breed is partly a function of the number of days until breeding time, i.e., a quail on November 1st has 170 days to make it through until breeding time (egg laying starts about April 20th according to studies in Missouri and Illinois), whereas a quail alive January 15th has only to make it through 95 days. Thus, as the breeding season gets closer, the population of survivors is extra sensitive to harvest. This is partly a result of hunters sometimes being more efficient at killing quail (for example, through persistence) than are natural predators.

Effect of January-February Harvest

Considerable research has illuminated these phenomena, particularly the timing of harvest. Researchers in Illinois, Florida, North Carolina, Texas and Kansas (Roseberry 1979, Curtis and Doerr 1989, Pollock et al.1989, Peterson 2001, Williams et al. 2004) observed that harvest during specific time periods, January or February, added to natural mortality, and subsequently lowered breeding numbers more than hunting earlier in the season. Williams et al. (2004:99) stated that "managers should recognize that harvest can significantly lower spring northern bobwhite breeding densities." and that "one way to reduce harvest effects is to assure that harvest timing occurs in early winter and hunting season length is minimized." Further, Roseberry pointed out that hunting in January was detrimental beyond the potential for additive mortality: 1) quail are more vulnerable to hunting because of diminished cover, and 2) birds not killed, but harassed, would suffer energy losses, and potentially higher mortality.

Implications for Missouri

The studies in Kansas (Williams 2004) and Illinois (Roseberry 1979) are compelling for Missouri because climate is similar and the farm landscapes studied provided only fair quail habitat. In the Carbondale, Illinois, study, Roseberry found that harvest mortality became additive beginning in January. Although Roseberry did not measure natural mortality (a modern day benefit of radio-telemetry), it is reasonable to assume that natural mortality was high in January, causing harvest mortality to shift from the compensatory to additive mode. The timing of this interaction can be applied to recent Missouri data to gain understanding of what could have happened in Illinois, and of the appropriate timing of harvest in Missouri. MDC's 1989-1992 study of radio-tagged farmland quail in Knox and Macon counties revealed causes and timing of mortality (Burger et al. 1994, figures 1, 2 and 3). For hens, natural mortality was substantially higher in January than any other month (Figure 1). In another manuscript on the same study (Burger et al. 1995), we focused on absolute harvest, independent of timing, and speculated that the 28% harvest rate we observed was cause for concern about over-harvest, particularly because habitat was marginal.

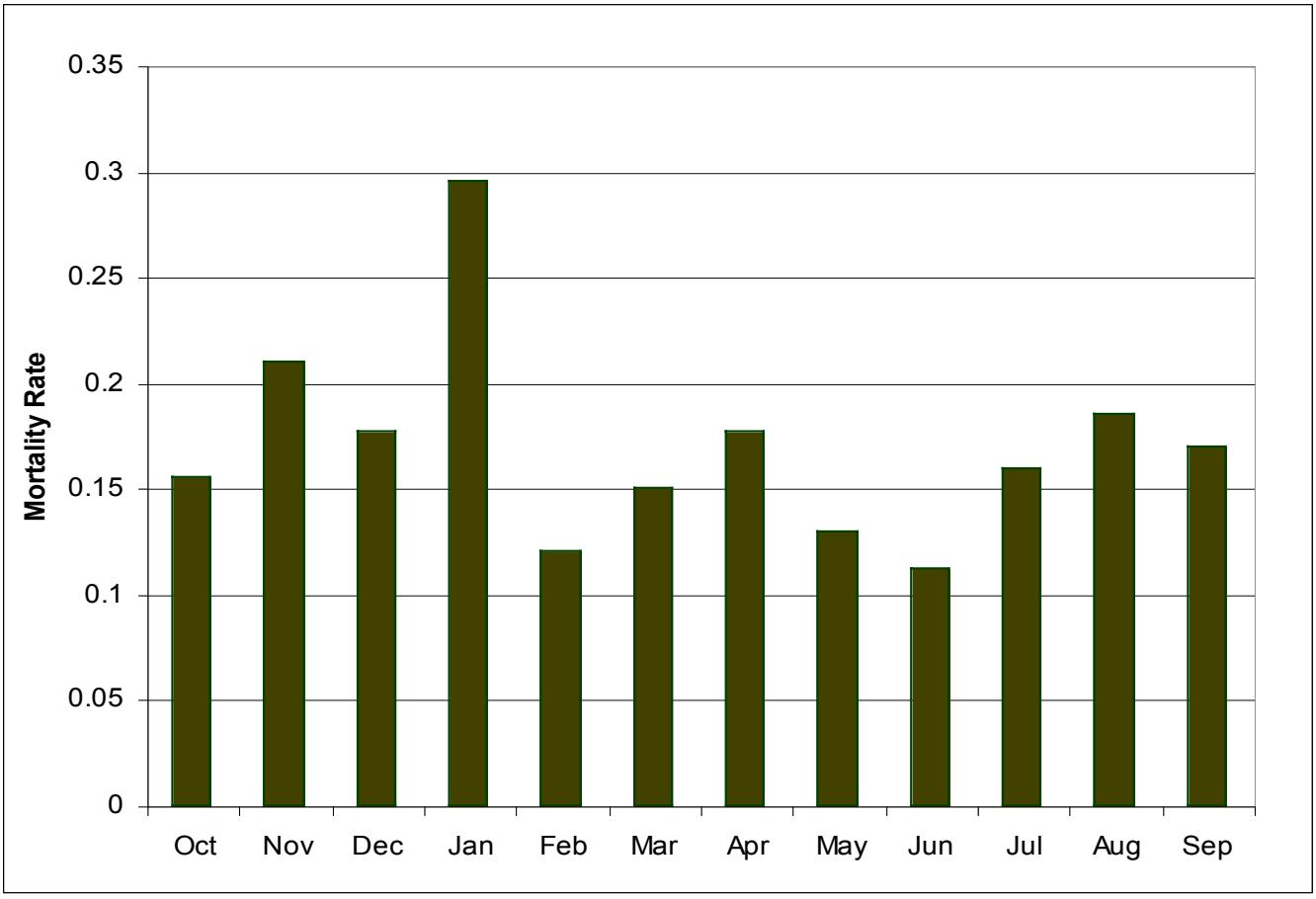

Figure 1. Monthly mortality of radio-marked female bobwhites from 'natural' causes (predation and unclassified causes) in Knox and Macon counties, 1989-1992.

Uncertainty

Although there is considerable empirical evidence that hunting mortality adds to natural mortality and results in reduced abundance of breeders, there is uncertainty about the importance of statewide hunting regulations. Among other things, Missouri quail hunter numbers have dropped from >100,000 per year in the 1980s to <40,000 per year in the 21st Century. There are numerous uncertainties that preclude assessment of risk to quail populations including local and large-scale harvest rates and hunting pressure, timing and amount of natural mortality, potential for density-dependent reproductive response, etc. The potential for annual density-dependent reproductive response is particularly important, with bobwhites being capable of rebounding from hunting-caused declines in breeder abundance (Roseberry 1979).

Hunting Issues

MDC collects harvest information from a post-season mail survey of a random sample of Missouri small game permit holders. The estimated number of licensed hunters that hunted quail during the 2003 season was 41,497, 63% below the long-term (1967-2002) average of 111,960 hunters. The harvest of 426,590 was 76% below the long-term average (1967-2002) of 1,817,395.

Avid Hunters

Although quail harvest and hunter numbers have reached alarmingly low numbers, hunting success has not declined as dramatically. Over 1967-2003, the trend in average daily bag declined 1.3% per year, whereas the harvest trend has declined 2.6% per year. Quail hunting is still a viable activity, and the remaining hunters are avid. Contrary to the popular idea that harvest rate goes down when quail abundance declines, analysis of Missouri and other states' data reveal that during lean years the remaining quail hunters efficiency increases (Figure 2). Thus, today's avid hunters have a greater impact than the dwindling total number of hunters would indicate.

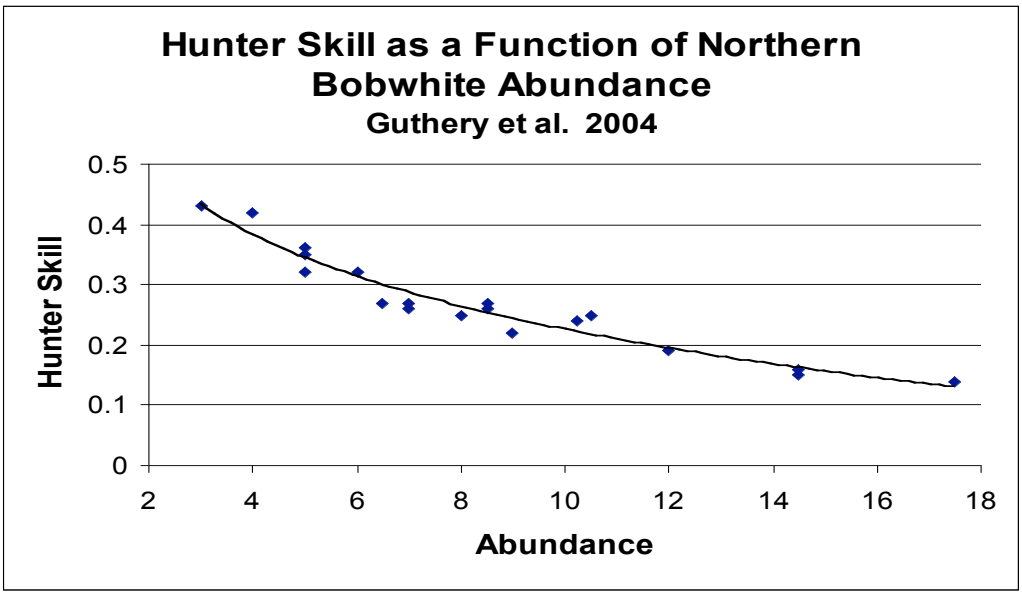

Figure 2. Missouri quail hunter skill as a function of bobwhite abundance (Guthery et al. 2004).

Pros and Cons of Early Hunting

As shown in Figure 1, following reproduction, quail populations are progressively depleted by natural mortality. This is not new information, as Missouri's Steen (1946) noted that "good management demands that harvest by the gun come as close to the production period as reasonably possible." Indeed, earlier hunting makes more birds available to the gun (Parmalee 1953, Kabat and Thompson 1963, McConnell 1972).

Other states have detailed description of early November quail hunting. By November 1 in Tennessee and Illinois, over 80% of all birds are 11 weeks-of-age and weigh about 152 grams, compared to 178 grams for older birds (McConnell 1972, Roseberry 1979). In Tennessee, an experimental November 6 opener revealed that 64% of the hunters felt that warm weather was only a minor problem, even though the temperature was abnormally hot (McConnell 1972). McConnell concluded that the vast majority of quail are suitable for hunting from the standpoint of size and sport, and that complainants are in the minority.

Missouri Quail Hunter Activity

How much do Missourians hunt quail in early season? Data from MDC's conservation area bag checks, and the avid quail hunter survey, show that on a week-by-week basis most birds are harvested during the first week of the season. Opening day on conservation areas is notoriously the busiest day of the year. Missouri hunters seem to be undeterred by the slightly warmer weather in early November.

The post-season small game harvest survey provides estimates of where people hunt quail, and it is divided into 8 zoogeographic regions (Figure 3). In 2003-04 season, number of hunters ranges from 9,729 hunters in the Northeastern Riverbreaks, to 1,613 in the Mississippi Lowland (Figure 4). With the exception of the Western Prairie, relatively few hunt in southern Missouri.

Figure 3. Missouri zoogeographic regions. Northwestern Prairie (NWP), Northern Riverbreaks (NR), Northeastern Riverbreaks (NR), Northern & Eastern Ozark Border (NEOB), Western Prairie (WP), Western Ozark Border (WOB), Ozark Plateau (OP), and Mississippi Lowlands (ML).

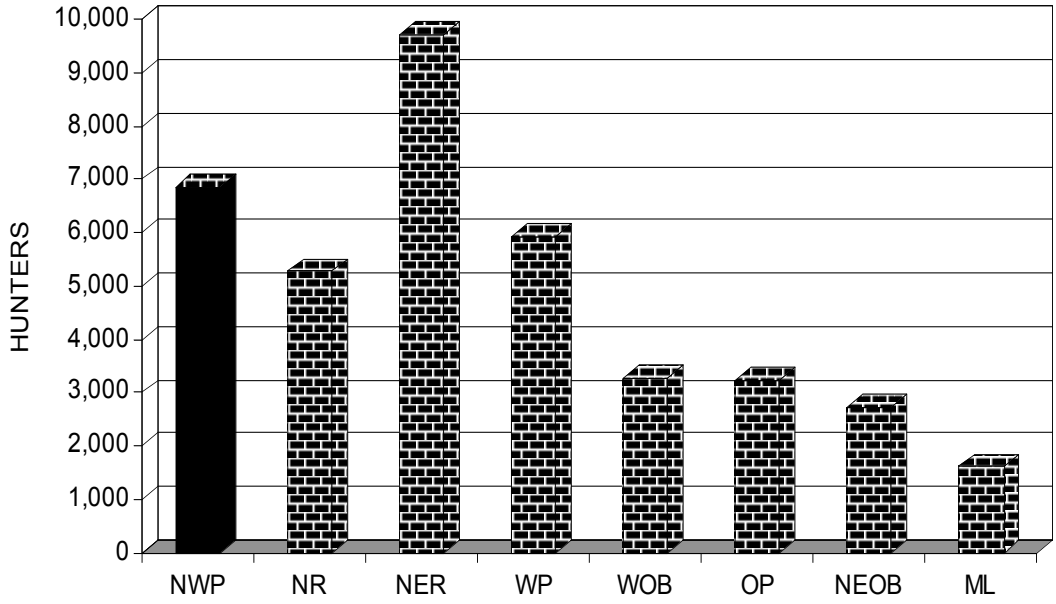

Figure 4. Number of Missouri licensed quail hunters by zoogeographic region during 2003-04 season as estimated from post-season mail survey of small-game hunters.

Quail hunting activity, however, does not follow this pattern. People hunting in the southern regions spend as many days in the field as those hunting in northern regions (Figure 5). In the Mississippi Lowland, where the current season structure is perceived to be an obstacle to hunting, hunting participation is high. Although quail (MDC 2004 quail status report) and hunters are most abundant in the Northwestern Prairie and Northeastern Riverbreaks, residents of quail-poor areas of the state (WP, WOB, OP, NEOB, ML, etc.) are avid quail hunters (Figure 5).

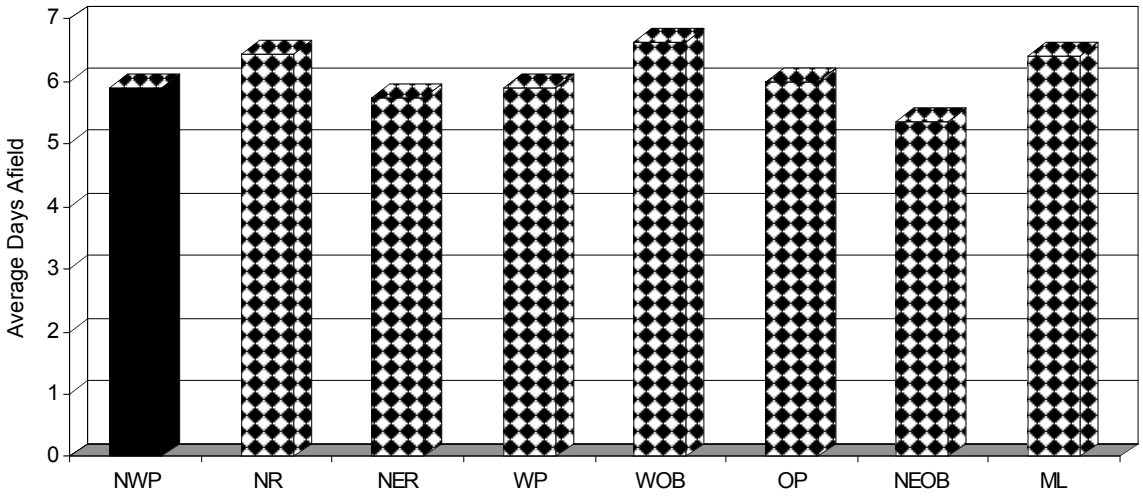

Figure 5. Average days afield by Missouri licensed quail hunters by zoogeographic region during 2003-04 season as estimated from post-season mail survey of small-game hunters.

Quail Hunting Regulations in Other States

Missouri quail hunters occasionally inquire about a late opener and hunting well into winter. They compare our season to more liberal nearby states, where quail are often hunted through January and in some states, into February (Table 1). The range of season opening dates (2004-05 season) 26 October to 19 November, and the closure range is 19 December to 28 February.

However, as noted by McConnell (1972:100), quail season structure in southern states has largely ignored sound biological reasoning in favor of tradition and non-biological factors. Midwest states, however, have recently moved toward more conservative regulations. For the 2006-07 hunting season, Kansas has moved the closing date from 31 to 21 January (Table 1). Likewise, Indiana is considering elimination of the January portion of the current hunting season (Table 1). On the other hand, Illinois liberalized its season at the request of hunters to nearly match Missouri's season, but biologists insisted hunting occur no later than January 15th because of the compelling evidence in Illinois (Roseberry's work) that January hunting reduces breeder abundance.

Table 1. Northern bobwhite 2004–2005 hunting seasons for nearby states.

State	Open date	Close date	Days	Daily bag	Possession
Arkansas	1-Nov	5-Feb	96	6	12
Illinois-north	5-Nov	8-Jan	64	8	20
Illinois-south	5-Nov	15-Jan	71	8	20
Indiana-north	5-Nov	19-Dec	45	5	10
Indiana-south[1]	5-Nov	15-Jan	72	8	16
Iowa	29-Oct	31-Jan	94	8	16
Kansas-east[2]	12-Nov	31-Jan	80	8	32
Kansas-west	19-Nov	31-Jan	73	8	32
Kentucky west	15-Nov	10-Feb	85	8	16
Kentucky east	1-Nov	31-Jan	91	8	16
Missouri	1-Nov	15-Jan	76	8	16
Nebraska East	26-Oct	31-Dec	66	6	24
Nebraska West	27-Oct	31-Jan	96	6	24
Oklahoma	13-Nov	15-Feb	94	10	20
Tennessee	13-Nov	28-Feb	107	6	12

1. For 2006-07 season, proposed 31 December closure and bag limit of 5.
2. For 2006-07 season, statewide season is 11 Nov-21 Jan.

Missouri Quail Hunters' Preferred Hunting Season Structure

We asked a question about hunting season timing in the 2004-05 post-season mail survey of licensed small game hunters. Opening date choices were November 1st (current), 8th (about 1 week prior to deer season), and 23rd (after deer season), and closing date choices were December 31st, and January 15th or 31st. The number of quail hunters responding ranged from 83 in MDC's St. Louis region to 399 in the Northwest MDC region. Extra sampling in the Southeast region resulted in a higher response (*n*=196 hunters); 79 were from the Bootheel counties of Dunklin, Mississippi, New Madrid, Pemiscot, Scott and Stoddard. The analysis was grouped by combinations of regional preferences for the above opening and closing dates.

As expected, the most popular choice is the longest season (1 November-31 January). This was expected because hunters were given no information about the potential biological consequences of the season structure, and thus, most would choose to increase their opportunities for recreation. Some dates were very unpopular, with 8 November opening date receiving <5% favor in any region-season structure combination. Also, the most conservative closing date (31 Dec) was relatively unpopular (<3.8% in favor), except for the Ozark and Northeast regions where 5.6-7.2% favored the early closure. The conservatism shown in these responses is an attitude expressed each year by some hunters answering the MDC Small Game Harvest Survey ('help the quail by closing down the hunting season for a year or two'). Because of the meager preference for the 8 November and 31 December dates, only data for relatively popular choices are shown below (Figure 6). Highlights of the graph for *traditional* (1 November-15 January), *longest* (1 November-31 January) and *late* (23 November-31 January) seasons follow:

- The longest season was the most popular choice with a range of preference by region of 24-42%.
- Disregarding the popularity of the longest season, hunters' preferences varied by region:
  - Southern regions disagreed about the late season, with preference of 29% in the Southwest, 8% in the Ozarks, and 22% in the Southeast.
  - Comparing the traditional and late seasons, the former was preferred by Northwest, Northeast, Central and Ozark hunters.
- Southeast hunters had almost equal preference for the long (24%), late (22%) and traditional (22%) seasons.
  - Bootheel hunters favored the late season (34%) over the long (22%) and traditional (15%) seasons.

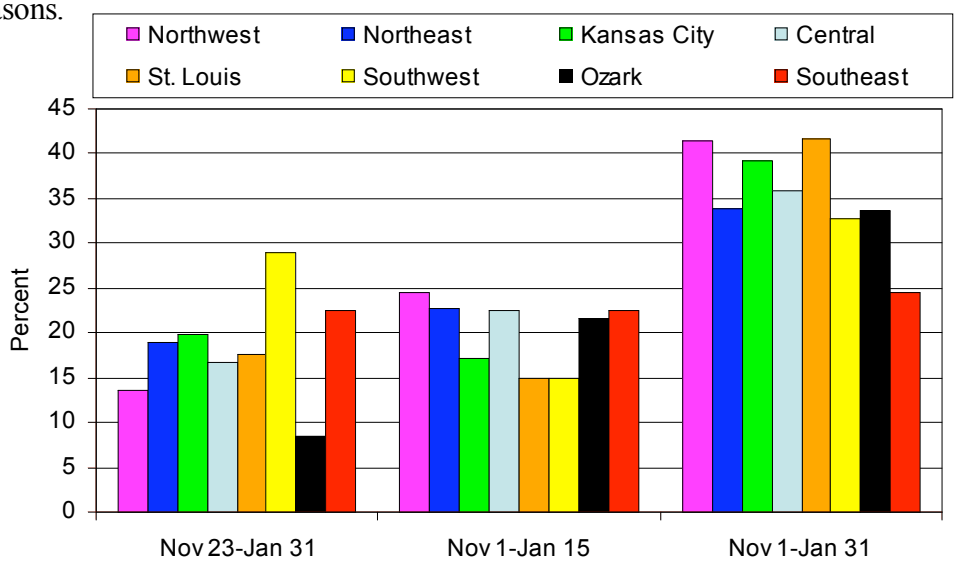

Figure 6. Percentages of Missouri quail hunters preferring traditional (1 Nov - 15 Jan), longest (1 Nov – 31 Jan), and late (23 Nov – 31 Jan) seasons. Calculated by MDC regions where hunters hunt most. Preliminary results estimated from the 2004-05 post-season mail survey of small-game hunters.

Hunting Regulations in the Context of Quail Restoration

The context of today's quail management is that we are in the midst of a major effort to improve bobwhite abundance through habitat management. Because >90% of this restoration will occur on private land, there is considerable uncertainty about the extent to which we will be successful.

The states' systems of quail hunting season regulations have recently been reviewed. Peterson (2001), Guthery et al. (2004) and Williams et al. (2004) concluded that statewide regulations are ineffective and inappropriate for today's dwindling quail populations and widely-distributed poor habitat. The suggested solution is region-based regulations that reflect habitat suitability. Most importantly, the increased knowledge of the quail's sensitivity to hunting led Williams et al. (2004a) to recommend conservative experimental regulations and monitoring; otherwise the researchers suggest we risk failing to stabilize, let alone increase, bobwhite populations.

There are important potential unintended consequences of more liberalized quail hunting regulations:

1. Quail abundance could decline with potential wide-ranging ramifications:
    a. In areas where little habitat restoration is being attempted, risk of extinction of local quail populations could increase
    b. Benefits (increased or stabilized quail abundance) of habitat-based restoration programs could be compromised
        1. Partners, such as the USDA, could use MDC quail hunting liberalization as an excuse to reduce their programs' benefits to quail
        2. Strategic Guidance objective of an increase in number of quail hunters could be compromised *if* regions cannot show that quail abundance has rebounded in focus areas. This is because recruitment of quail hunters is heavily dependent on a dramatic increase in quail abundance. There is no planned measurement of hunter success below the level of MDC regions, so any improved hunting by current hunters would be anecdotal.

2. In addition to effects on quail, the public's perception of more liberal hunting regulations needs to be considered. MDC quail restoration kick-off events in each MDC region in April carried the message that quail were in trouble and we (leadership council, MDC and partners) were leading the effort to increase quail habitat and quail abundance statewide. Many newspapers covered these events (e.g. St. Joe, Chillicothe, Jefferson City, Lebanon)(http://intranet/portal/Newsclips_Overview.asp?FormName=Search&FormAction=search&s_headline=quail&s_description=&news_source=), spreading the message well beyond the meetings themselves. In response to the quail restoration message, the public is likely expecting more conservative regulations, reasoning that less exploitation is good for the quail population. Moreover, a public expectation for more conservative regulations could result from the recent announcement that Kansas trimmed 10 days from the end of their 2006-07 quail hunting season (http://www.kswildlife.org/index.php?s=robel) (http://www.kdwp.state.ks.us/news/kdwp_info/commission/past_meetings/2005/june_2005).

Literature Citations

Burger, L. W., Jr., M. R. Ryan, T. V. Dailey, and E. W. Kurzejeski. 1994. Temporal patterns in cause-specific mortality of northern bobwhite in northern Missouri. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 48:208-219.

Burger, L. W., Jr., T. V. Dailey, E. W. Kurzejeski, and M. R. Ryan. 1995. Survival and cause-specific mortality of northern bobwhite in Missouri. Journal of Wildlife Management 59:401-410.

Cannon, R. 1985. Habitat, hunting and bobwhite quail. Missouri Conservationist. August. Pages 4-8.

Curtis, P. and P. Doerr. 1989. Late season quail hunting: Are we mortgaging our future? Quail Unlimited, Inc. Magazine, Volume 8, No. 2. Pages 14-15.

Dailey, T. V. 1997. Quail population ecology. Final Report, P-R. MDC files.

Guthery, F. S. 2002. The technology of bobwhite management: the theory behind the practice.

Guthery, F. S., M. J. Peterson, J. J. Lusk, M. J. Rabe, S. J. DeMaso, M. Sams, R. D. Applegate, and T. V. Dailey. 2004. Multi-state analysis of fixed, liberal regulations in quail harvest management. Journal of Wildlife Management 68:1104-1113.

Kabat, C., and D. R. Thompson. 1963. Wisconsin quail, 1834-1962—population dynamics and habitat management. Wisconsin Conservation Department Technical Bulletin. 30. 136pp.

Kokko, H. 2001. Optimal and suboptimal use of compensatory responses to harvesting: timing of hunting as an example. Wildlife Biology 7:141-150.

McConnell 1972. Early quail hunting season in Tennessee: reasons and results. Proceedings of the First National Bobwhite Quail Symposium. Pages 100-114.

Parmalee, P. W. 1953. Hunting pressure and its effect on bobwhite quail populations in east-central Texas. Journal of Wildlife Management 17:341-345.

Peterson, M. J. 2001. Northern bobwhite and scaled quail abundance and hunting regulation: a Texas example. Journal of Wildlife Management 65:828-837.

Pollock, K. H., C. T. Moore, W. R. Davidson, F. E. Kellogg, and G. L. Doster. 1989. Survival rates of bobwhite quail based on band recovery rates. Journal of Wildlife Management 53: 1-6.

Robinnette, C. F., and P. D. Doerr. 1993. Survival of hunted and nonhunted study areas in the North Carolina sandhills. Proceedings of the National Quail Symposium 3:74-78.

Roseberry. 1979. Bobwhite population responses to exploitation: real and simulated. Journal of Wildlife Management 43:285-305.

Steen 1946. Missouri Department of Conservation files.

Williams, C. K., F. S. Guthery, R. D. Applegate, and M. J. Peterson. 2004a. The northern bobwhite decline: scaling our management for the twenty-first century. Wildlife Society Bulletin 32:861-869.

Williams, C. K., R. S. Lutz, and R. D. Applegate. 2004b. Winter survival and additive harvest in northern bobwhite coveys in Kansas. Journal of Wildlife Management 68:94-100.